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HAND-BOOK OF PLANT DISSECTION

Hand-Book of Plant Dissection. By J. C. Arthur, M.Sc., Charles R. Barnes, M.A., and John M. Coulter, Ph.D. (New York: Henry Holt and Co., 1886.)

THIS work will take the same place in the botanical teaching of the United States as will be occupied in this country by the "Practical Botany" of Messrs. Bower and Vines, when the latter is completed. Both are essentially guides to the laboratory instruction which now forms the most important part of every efficient course of botany.

The American hand-book differs from its English prototype in two important respects: first, in the fact that it begins with the lowest plants, while the English work begins with the highest; and secondly, in its more rigid adherence to the type system. Prof. Bower did not limit the work entirely to the main types, but frequently introduced other plants, which happened to be more favourable for the study of particular points of structure. The authors of "Plant Dissection," on the other hand, give us the type, and the type only. Their plan has the advantage of simplicity, but several points have to be passed lightly over which could have been studied efficiently in plants other than the selected types. On the whole, the more elastic method of the "Practical Botany" seems to us to be more satisfactory. Any teacher of botany would select Cucurbita for the study of the sieve-tubes, Caltha, or some allied plant, for the embryo-sac, and so on; and yet these are not plants which would be well suited for generally typical examples.

As regards the other point, whether it is better to begin at the upper or lower end of the vegetable kingdom, it may perhaps be said that the former is the course better adapted for beginners, while the latter has its advantages in the case of advanced students. If the learner has no previous knowledge of plants at all, it may be difficult to rouse his interest in such obscure forms as Oscillaria or Cystopus, while the study of some familiar plant, such as the sunflower or shepherd's purse, is much more likely to attract him. On the other hand, if some preliminary knowledge may be assumed, there will be no objection to following the strictly logical course of proceeding from the simpler to the more complex.

The "Hand-Book of Plant Dissection" begins with a short introduction on reagents, section-cutting, &c., and then come the types, occupying the bulk of the work. They are twelve in number, and have been selected as follows:—For the lower Chlorophyceæ, *Protococcus viridis;* for the Cyanophyceæ, *Oscillaria tenuis;* for the Conjugatæ, *Spirogyra quinina;* for the Phycomycetes, *Cystopus candidus;* for the Ascomycetes, *Microsphœra Friessi;* for the Liverworts, *Marchantia polymorpha;* for the Mosses, *Atrichum undulatum;* for the Ferns, *Adiantum pedatum;* for the Gymnosperms, *Pinus sylvestris;* for the Monocotyledons, *Avena sativa* and *Trillium recurvatum;* and lastly, for the Dicotyledons, *Capsella Bursa-pastoris.* It will be seen that while one or two of these plants are strictly American forms, most of the types are cosmopolitan.

It would be easy to criticise the selection in some of the cases: thus, "Protococcus" is not really entitled to the first place on the list, for its cells are more highly organised than those of the Oscillaria. Pythium shows the sexual organs much better than Cystopus, and Microsphæra is perhaps not so characteristic an Ascomycete as might have been found. On the whole, however, the types are good ones.

A few points may be mentioned where there appears to us to be room for serious criticism. It is evident from the remarks on p. 55 that Sachs's old classification of the Thallophytes is adhered to. Surely after the publication of De Bary's papers in the *Botanische Zeitung*, in 1881, and of Goebel's "Grundzüge der Systematik," in 1882, there is no excuse for retaining this manifestly artificial arrangement. Sachs's grouping of the Thallophytes by their sexual organs alone, without any regard to general structure, has been unkindly, but pointedly, compared to the sexual system of Linnæus, which is not usually reckoned as a natural arrangement. How inexpedient the classification in question is for the student is well shown in the work before us on the page referred to, where the reader is advised to study Nemalion or Batrachospermum in order to understand the fruit of Microsphæra. Can any one seriously believe that detailed homologies can be traced between so isolated a group as the red seaweeds and a highly specialised parasitic member of the Ascomycetous Fungi?

Going on to the chapter on the Liverwort, the footnote on p. 75 seems likely to confuse rather than to enlighten the student. The archegonia are *not* called sporogonia after fertilisation by any one who wishes to keep the distinction between the sexual and asexual generations clear in the mind of the learner. The sporogonium arises from the oosphere only; the archegonium, as distinguished from the oosphere, takes no part in its formation.

In the same chapter a statement on p. 82 that "the antheridia are modified hairs" demands notice. This is a bad example of old-fashioned morphology. The antheridia of the Liverworts are modified successors of the antheridia of the lower plants. The ancestors of highly organised plants like Marchantia must have long possessed sexual organs, probably at least as long as they have possessed "trichomes." The same mistake reappears on p. 120 in the description of the fern, when the "trichomes" are said to appear "in the form of sporangia." Either this is merely a roundabout way of stating that the sporangia are of epidermal origin, or else it means that these reproductive organs are actually due to the modification of hairs. The latter view will hardly commend itself to any one who realises that the spores of the fern are homologous with those of the Muscineæ.

A repetition of the same confusion of ideas on p. 125 need not be further noticed.

In the account of the anatomy of the leaf of Pinus there is an error as to a simple matter of fact which ought to be corrected. On p. 154, *d* and *e*, the thin-walled cells of the mesophyll, are said to be empty, while those with bordered pits are described as having "more or less conspicuous contents." This is just the reverse of the truth. The thin-walled cells have protoplasmic con-

tents throughout life, while the tracheides with bordered pits (transfusion tissue) contain, in the mature condition, nothing but water.

On p. 164 the statement that there is finally "free communication" between the contiguous tracheides of the wood of Pinus is erroneous. The pits are closed, at any rate as long as the wood serves its main function of conveying the sap.

At p. 171, in the same chapter, there is a repetition of Hofmeister's old mistake as to the deliquescence of the original cell-walls of the endosperm in the Conifers. Strasburger showed in his "Angiospermen und Gymnospermen," that this idea was due to Hofmeister having confused the disorganised cells of the nucellus with those of the endosperm. The Conifers have one and the same endosperm throughout the development of the ovule: there is no distinction of "primary and secondary" endosperm.

Judging from the footnote on p. 209, there seems to be some confusion between the xylem and the bundle-sheath in Trillium.

It is to be regretted that the student is not shown how to investigate the minute structure of the angiospermous embryo-sac when ready for fertilisation.

In spite of the rather serious faults noticed, the book on the whole is a good and useful one. D. H. S.

MR. MERRIFIELD'S "TREATISE ON NAUTICAL ASTRONOMY"

A Treatise on Nautical Astronomy for the Use of Students. By John Merrifield, LL.D., F.R.A.S. (London: Sampson Low, Marston, Searle, and Rivington, 1886.)

THIS is an excellent work for the student, evidently compiled with considerable care, which may also be consulted with advantage by the seaman. Of course the author does not claim originality, excepting in one particular, viz. a method of his own for "clearing the lunar distance," as, in point of fact, nearly everything the work contains has been published in previous treatises. Mr. Merrifield deserves, however, the credit of placing clearly before the student many points which are only touched on by other writers—notably the account of the correction for refraction, and the explanation of the fact that the maximum altitude is not invariably the meridian altitude, a point which is only touched on by a footnote in Raper, and is usually ignored entirely; yet which is of considerable importance in the case of the moon. The examples, also, which are given at the end of each chapter are of great use to the student, as from them a knowledge is obtained of the subjects he is likely to be examined in; and as these questions have been selected from many examination papers, they are an excellent guide. In the theoretical part of nautical astronomy the book is nearly all that can be desired, and this part can always be learnt better on shore than in a ship, where the constant noise and interruption, together with perpetual motion at sea, renders study all but impracticable: in one or two cases, however, Mr. Merrifield also touches on the practical use of instruments, &c., and on these subjects he is naturally not so good an authority. It may perhaps, therefore, be advisable to point out the usual course of proceedings in Her Majesty's surveying-vessels, both in correcting instruments and also in ascertaining positions at sea.

First, with regard to the sextant, the error of collimation is not readily obtained, as stars only are available, and there are no means of illuminating the wires in the telescope, so that a bright moonlight night is requisite. Secondly, with respect to the errors of centering and graduation, Mr. Merrifield suggests that the combined error should be ascertained by means of measuring the distance between several pairs of stars by the instruments, the correct distances having been previously calculated. But here the varying nature of the refraction prevents good results, and a better method is to measure the distances both by the sextant and by the repeating circle, as in the latter instrument all errors are eliminated.

In the account of the artificial horizon Mr. Merrifield says that "it is used for taking altitudes when the sea horizon is obscured," being apparently under the impression that it can be used on board a vessel. Were such the case, it would often relieve the mind of many an anxious navigator, but, unfortunately, the constant motion of a ship altogether precludes its use at sea; it is true that the late Capt. Becher, R.N., invented a method of observing altitudes at sea, in foggy weather, by attaching a small pendulum, suspended in oil, outside the horizon-glass of a sextant; to this a horizontal arm was fastened which carried at its inner end a slip of metal showing the true horizon when seen in a certain position; but this did not prove a success, and is now almost forgotten; and there is nothing to trust to but the compass and log when the horizon is obscured. The true use of the artificial horizon is to obtain observations on shore, and the sea horizon should never be used then. The best artificial horizon is a trough filled with mercury, covered with a glass roof, but this cannot be used in the extreme cold of the Arctic regions, and consequently there a plate of dark glass is substituted, which is adjusted by spirit levels. The error of the artificial horizon is due to two causes, first the imperfections in the glass roof, which, as Mr. Merrifield remarks, may be guarded against by reversing the roof; and secondly, owing to the attraction of mountain masses causing the mercury to depart from the true level. Could some means be found which would enable the seaman to take observations, in a vessel, independently of the sea horizon, it would be the most useful nautical discovery of the age, but this is not to be effected, as Mr. Merrifield suggests, by mounting the artificial horizon on gimbals, for even if the ship were in herself rigid, the motion at sea would preclude the possibility of obtaining observations, as the position of the observers could not be changed with sufficient rapidity to suit the ever-varying angle of reflection from the horizon, with respect to the observer on the deck; and Mr. Merrifield's own experiences of the difficulties of obtaining observations from the roof of a quiet house must have taught him that it would be much more difficult in a vessel which is constantly vibrating from the motion of the engines or other disturbing causes. The idea of placing a piece of glass on the mercury to still its vibrations, was some years ago promulgated by the late Staff-Commander George, attached to the Geographical Society, who invented a very useful little artificial horizon